Utilizing information systems in inter-organizational collaboration and information sharing

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Information systems are becoming more commonly used in inter-organizational collaboration in attempt to improve the value chain performance. Information sharing is an important part of inter-organizational systems, but entering a more open relationship with business partners is still difficult for most large companies.

The purpose of this thesis is to identify the requirements to successfully enhancing inter-organizational collaboration with the help of an information system, in particular, to increase the performance of a buyer-supplier relationship. The second aim is to find out if there are any organizational barriers to a successful implementation of an inter-organization system. The requirements, challenges and benefits of the collaboration systems are handled from the combined system and collaboration point of view. Using an information system for strategic collaboration is a development for existing collaboration between the parties, therefore the themes must be discussed together.

The research is conducted as a case study research involving one case organization, which is a Finnish company operating globally. At the time of writing the thesis it was implementing a collaboration system with their raw material suppliers. The methods used for the research were a survey and semi-structured interviews. The results showed that the system development in the company is heading towards increasing vendor integration and connectivity. One issue was that the new systems are developed on existing processes. The opportunity of streamlining the processes mutually on both sides of the collaboration is not fully utilized in the new system development. The research showed that the employees of the case company are committed to the supplier relationship and willing to collaborate, but the information sharing in the case company needs improvement to be able to support the inter-organizational collaboration.

Keywords and terms: inter-organizational collaboration, inter-organizational system, information sharing

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1. Introduction

1.1. Presentation of the topic

Information systems (IS) are an enabling means to business-to-business (B2B) collaboration and many companies want to utilize the systems to gain competitive advantage. Inter-organizational collaboration (IOC) refers to actions that are carried out to increase the performance of a buyer-supplier relationship. It is an ongoing process where information and the respective information systems are being used to exchange business data. [Madlberger & Roztocki, 2010]

The utilization of the possibilities of IS in a fast-changing business world requires dynamic capabilities from an organization. That means instead of only managing the current actions, companies should be able to look forward, assess the opportunities and challenges and after that align their future activities to gain sustainable competitive advantage. [Teece, 2007]

Information systems offer the possibility to develop collaboration between companies. With the help of an inter-organizational system (IOS), partners can move forward from the purely transactional data sharing to an interactive and more transparent collaboration where the information flow and communication are continuous and mutual. Supply chain connectivity through information technology (IT) and information sharing can have a large effect on a company's performance when they are combined together [Fawcett et al., 2011].

The research in this paper is concentrating on B2B relationships, especially on buyer-supplier collaboration and the connections continuing upstream in the supply chain. The buyer-supplier link includes several important activities in the supply-chain and links to other functions in an organization, e.g. R&D. The collaboration and information sharing of the partners can be made more efficient through the features of modern IT-solutions.

At this stage the research is limited to the situation where the main actor is collaborating with its suppliers, but the suppliers are not interacting with one another. This research is also mainly concentrating on the internal factors that influence inter-organizational collaboration and systems. The topic of this thesis combines themes from business, information systems research and information science.

Salmivalli *et al.* [2008] state in their conference proceedings that even though computers have a critical role in inter-organizational collaboration, the coordination of the IT-

decisions within these organization networks is fairly an unexplored area in research and in practice. Loebbecke *et al.* [2016] also see the opportunity to further examine strategic information systems and inter-organizational information sharing. Information systems can support the companies' needs to handle the processes of information sharing between them.

1.2. Research questions and methods

Based on the findings about the gaps in research in the extant literature together with the requirements of the case company, the study is conducted to find answers to two questions:

1. *What is required to successfully enhance inter-organizational collaboration with the help of an information system?*
2. *What kind of organizational barriers exist to a successful implementation of an inter-organizational system?*

Both research questions address the system-side as well as the collaboration between the buyer and the supplier. The themes in the research questions are discussed in the literature review and finally tested and answered conducting a case study in an organization that is implementing an inter-organizational system with its raw material suppliers.

The literature review is written using the latest relevant research results that were available to the writer concerning the topic. One issue is, that the nature of information systems literature is very fragmented. Madlberger and Roztocki [2009] state that there still is a large heterogeneity in the approaches used in information systems literature and the concept of collaboration lacks a common understanding. Also, the amount of literature available on information system —based inter-organizational collaboration is limited [Markus & Bui, 2012]. There is some research to be found, but a lot of it remains unfound because of the fragmented and inconsistent use of terminology, partly because the research about this subject is made in different disciplines, such as business, computer science and information system research.

The subject is very multilayered, and it is depending on the point-of-view, what themes are important to include. The themes that are handled in this thesis were chosen to mirror and support the information system development actions in the case company at the time of writing this thesis.

The empirical research is conducted as a single-case study. The case approach is used to understand and explore the dynamics in one single environment [Eisenhardt, 1989] and to study a phenomenon in a real-life context [Yin, 2009]. The approach of the study is more of a theory-testing research than theory-creating research [Järvinen, 2012]. The themes and predictions found in theories are tested against the observations made from the gathered research data.

The case research is done using a triangulation of data gathering methods, combining quantitative and qualitative data. The qualitative data is used to complement and support the quantitative data. The use of more than one method enables examining the case from multiple perspectives [Jick, 1979]. According to Jick [1979], the use of complementary methods can also result to more valid results.

The data gathering methods chosen are an online survey and semi-structured interviews, which are conducted in the case study organization and partly in its parent company. The survey is conducted to clarify the current situation in the case company and to find the possible organizational barriers to collaboration: do the barriers lie e.g. in the systems, in the willingness of the personnel or in issues in information sharing internally or externally. Finding the barriers helps the management to make necessary internal adjustments and minimize the negative effects of implementing a joint information system. Semi-structured interviews are used to get a deeper understanding of the themes of this thesis in the case company and its parent company and to explain and support the results from the survey.

1.3. Structure of the thesis

There are two main parts in this thesis. The first part presents the theoretical background of the study and the second part is a case study using empirical research to answer the research questions. The literature review is first going through the main concepts and the important enablers and barriers to inter-organizational activities, be it system or strategic collaboration, concentrating on the buyer-supplier relationship. Through the themes that are coming up in the literature review, a study is conducted in the case company to find out the current situation of inter-organizational collaboration with the raw material suppliers and the ability, systems- and organization-wise, to build and implement a more transparent, inter-organizational information system.

The theoretical part is further divided into two sections. Chapter 2 considers the digital collaboration between the organizations from the collaboration point of view. It goes through what sort of collaboration is done between the buyer and supplier and what is

needed to manage this relationship. Inter-organizational information sharing, which is an integral part of the collaboration, is discussed in its own subchapter. Chapter 3 is adding the layer of inter-organizational systems on top of the collaboration. There the features, requirements, challenges and benefits of the collaboration systems are handled from the combined system and collaboration point of view.

Chapter 4 introduces briefly the case study organization and the main features of their supplier information management system. Chapter 5 summarizes the results and shows the current situation of the case company regarding information systems, internal and external information sharing and collaboration with raw material suppliers. In chapter 6 the results are analyzed and discussed.

1.4. Delimitations

This work mainly considers the internal factors on the buyer's side that are affecting the collaboration. A broader research and experience is needed to find out how the suppliers perceive the collaboration and information systems used in it.

Concentrating on only one relationship in the supply chain (buyer-supplier) might not be enough, because problems further up the stream might cause problems in the processes downstream [Selk et al., 2005]. The inter-organizational system should be utilized even further up and down the supply chain or the information flow has to be secured another way to make the supply chain more efficient and responsive.

The relationships of the partners are different, depending on whether the partner is a customer or a supplier. Hence the management style has to be thought separately for the different links in the chain. This research cannot as such be generalized across the whole supply chain. To be able to achieve benefits from an inter-organizational system, it must be part of a wider supply chain and related information system strategy. The supply chain strategy is not discussed thoroughly in this paper.

This thesis is written concerning the collaboration between the case company and the raw material suppliers. With some consideration and adjustments this might be applied to indirect materials and services –suppliers, but those have not been included in this thesis.

Here the local aspects of inter-organizational collaboration and systems are not separately taken into consideration. Local aspects mean for example the need to collaborate only with a certain department of the supplier or partner's subsidiary in a certain continent. The cultural and local ways of working may vary. The collaboration in this thesis is

considered in general terms as collaboration between two partners. The needs for local adjustments must however be taken into consideration when implementing the system and thinking about the possible users in all the partner organizations.

Many articles concerning inter-organizational systems were mostly about standard transactional B2B e-commerce systems, EDI-messaging or customer relationship management (CRM). Those articles were left out of the reference literature. Although, EDI-messaging is mentioned in some relevant references, it is not raised as a main point here. Also, articles appeared about co-innovation and co-creation, meaning initiatives and projects started with crowd-funding or ideas gathered in an innovation ecosystem for start-up companies. Those were also out of scope.

2. Inter-organizational collaboration

In this chapter, the definition of inter-organizational collaboration will be explained as well as the different digital forms of such collaboration.

2.1. Definition

Inter-organizational collaboration (IOC) is the collaboration between different actors within a production network [Buxbaum-Conradi et al., 2015]. IOC is based on principles from supply chain management (SCM) and for example collaborative planning, forecasting and replenishment (CPFR) [see e.g. Turban *et al.*, 2015 for CPFR]. Inter-organizational collaboration is allowing members of the value chain to collaborate in the design and development of products, manufacturing processes, logistic- and distribution strategies as well as supply and demand chain planning [Horvath, 2001] with greater success than carrying out the actions independently [Simatupang and Sridharan, 2002]. The collaboration can be improved by basing decisions on shared information about planning and forecasting [Caglio and Ditillo, 2008].

The IOC discussed here is concentrating on strategic collaboration. Purely transactional collaboration is mainly left out of the discussion. The collaboration category considered here is vertical collaboration with external suppliers (see Figure 1). Examples of such collaboration are vendor managed inventory (VMI) and collaborative planning, forecasting and replenishment (CPFR). Also, the social, uncontracted and informal collaboration [Caglio and Ditillo, 2008] is part of the inter-organizational relationship. Collaboration with customers or horizontal collaboration with other organizations or competitors [e.g. Barratt, 2004] are out of scope of this study.

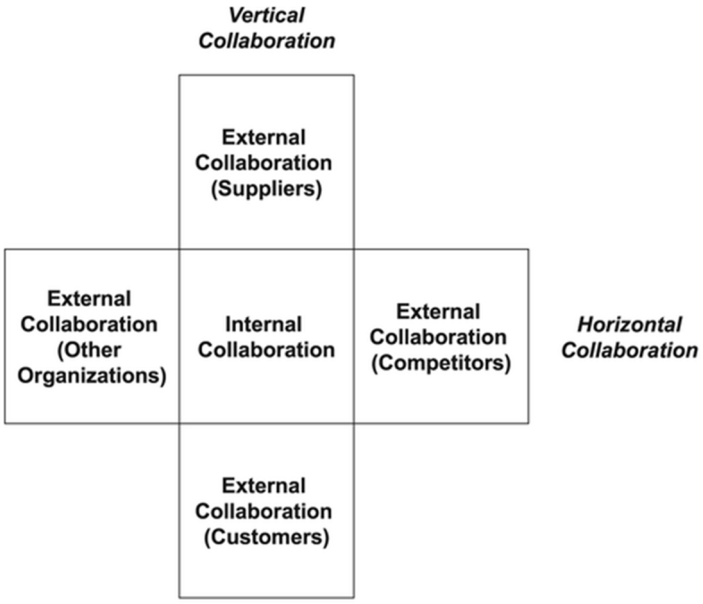

Figure 1. The scope of collaboration: generally [Barratt, 2004]

Companies implement IOC to gain the competitive edge that will help all parties in the value chain to grow, because competition in business is no longer just between companies, but between supply chains [Horvath, 2001; Hult *et al.*, 2007]. Horvath [2001] continues that to optimize the whole supply chain, companies need to share information and collaborate, which was previously not considered an option in most businesses. To be able to achieve the maximum performance level of the whole supply chain, companies should make decisions that not only benefit their own business but ones that create benefit extensively in the value chain.

2.2. Buyer-supplier relationship management

The collaboration and relationship management style is affected by the organization's power relative to its supplier. Kraljic [1983] presented his ideas for strategic purchasing decades ago and those ideas still can be used as a base when planning the company's purchasing activities. Kraljic [1983] suggested that companies categorize what they buy across two dimensions: profit impact and supply risk, as seen in Figure 2. Based on that evaluation, the company can decide its approach from three types of purchasing strategies: exploit (when buyer dominant), balance (when balanced relationship) and diversify (when supplier dominant) [Keith *et al.*, 2016].

There has been some criticism towards the adequacy of these factors to be the base of strategy decisions [Gelderman and Van Weele, 2005]. There can be for example measurement problems in determining the distinction between high and low supply risk. For more criticism subjects, see Gelderman and Van Weele [2005]. Carlsson [2015] suggests that individual supplier positioning complements the Kraljic matrix. The positioning could be done through a predefined model or companies can have their own positioning model of the suppliers in different categories. The combination of the different models gives assistance in defining the suitable approach for purchasing actions as well as collaboration.

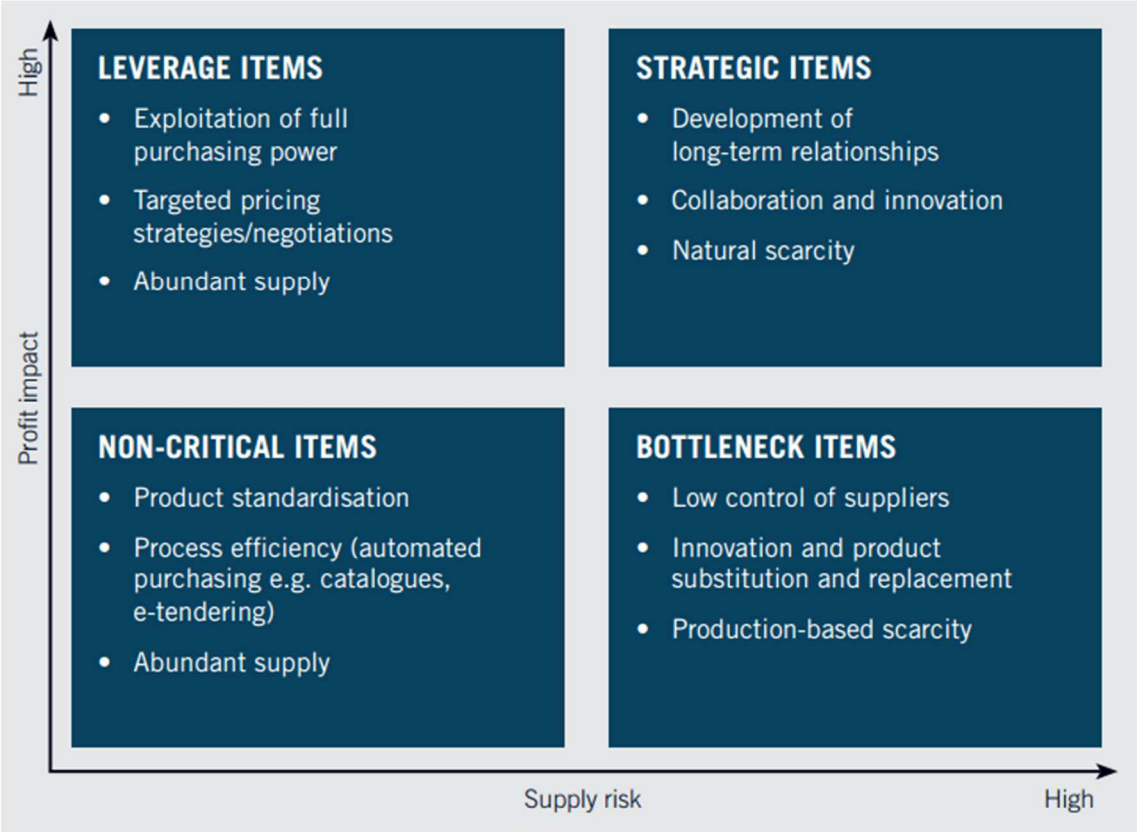

Figure 2. Kraljic matrix, Based on Kraljic [1983], source: Forbes [Webb, 2017]

Benton and Maloni [2005] approached the buyer-supplier relationship by testing the influence of supply chain power on supplier satisfaction. They define supplier satisfaction as the feeling of equity with the relationship no matter what power imbalance exists. There is a possible contradiction between the balance of power and satisfaction, but it can be handled by the power source by managing the power influences towards the partners. Benton and Maloni conclude that the supplier satisfaction is more relationship-driven than performance-driven. In fact, a good supplier relationship enhances the performance on both sides. Nyaga *et al.* [2010] ended up in similar results in their research on supply chain relationships between the buyer and supplier. The result that the satisfaction is more relationship driven enhances the importance of the relationship management no matter what are the power relations. Hingley [2005] added that collaborative and competitive strategies are not total opposites and that they can co-exist.

Aminoff and Tanskanen [2013] studied control between the supply chain partners and they argue that the control in the relationship looks different from the buyer's and supplier's view. Both parties, buyer and supplier have control over processes and it can also vary between different product groups. The control over different processes can be relinquished to the other party based on trust or power. The control in the buyer-supplier

relationship is a complex concept and the business managers have a task to find out how the other party perceives the control to avoid mismatches.

A buyer-supplier relationship that is collaborative in nature requires that the partners are autonomous. This means that both sides have control over their actions and behaviours. [Hartono & Holsapple, 2004]Their statement supports the idea in Aminoff and Tanskanen's [2013] research about control.

Trust is also important in bilateral relationships. Trust (together with knowledge of own and partner's capabilities) helps dividing the responsibility of the collaboration processes between the partners. [Aminoff and Tanskanen, 2013] Buyers trust is also contributing to a successful long-term buyer-supplier relationship [e.g. Cannon *et al.*, 2010]. In Barratt's [2004] research about collaboration in the supply chain, internal and external trust is one factor in the collaborative culture that supports collaborative actions. Other elements in the collaborative culture are mutuality, information exchange, openness and communication.

Organizations may be hesitant to begin a deeper, collaborative relationship with their suppliers, wondering if it really pays off. Nyaga *et al.* [2010] provide their support to collaborative actions stating that they offer valuable benefits to both, buyers and suppliers. (More about benefits in inter-organizational information systems in chapter 3.4.) Daugherty *et al.* [2006] also came to the conclusion that collaboration does pay off but the management needs to do more to gain the advantages. The writers also noticed that formalized collaboration relationships, with formal rules, standard policies and operating procedures, were more successful than less formalized. They listed three key areas that were critical in achieving the maximum benefits of a formalized collaboration. They are strategic performance measures, information sharing and monitoring, and inventory management. More on requirements in chapter 3.2.

Trust, power, control, and the inter-firm relationship influence how the collaboration between the parties in the supply chain is founded and how it succeeds [e.g. Aminoff and Tanskanen, 2013; Redlich et al., 2014]. Those factors do not necessarily define how companies share information between them [Madlberger, 2009]. Information sharing is discussed in the next chapter.

2.3. Information sharing

When organizations collaborate with each other, information sharing plays a very important part in it. Information sharing also has a significant impact on supply chain performance [Wu et al., 2014]. Information sharing has a stronger effect on commitment for the suppliers than the buyers. This means that suppliers are likely to be more committed in a relationship with a buyer that shares information, because that helps the supplier to provide products and services more effectively [Nyaga *et al.*, 2010]. According to Fawcett *et al.*, [2011] the willingness to share information and structured mechanisms for sharing enable a more innovative supply chain relationship.

Like stated in the last chapter, trust, power and inter-firm relationships have an influence on how successful a collaboration will be but those factors do not in all cases define how companies share information with each other [Madlberger, 2009]. Madlberger states, that information sharing is a prerequisite for collaboration.

An empirical study conducted a few years back revealed that the key drivers for information sharing are purely internal factors. The study did not find a link between inter-organizational factors, such as trust, good relationship or power, to be the antecedents of inter-organizational information sharing. Instead, the company's own information policy, top-management commitment, internal technical readiness and perceived benefits were drivers for inter-organizational information sharing. [Madlberger, 2009] In other words, the top management, company's own information policy, technical issues and low perceived benefits can stand in the way of inter-organizational information sharing on both, buyer and supplier, sides.

Zaheer and Trkman [2017] dig one level deeper into the subject and want to emphasize the aspect of willingness to share information in the supply chain. Their research aimed to improve the understanding of the willingness to share, find out its antecedents and its role in improving information sharing quality. In their research results trust affected the willingness to share information. The higher the willingness, the better the information quality, which in turn affects business decisions. IT infrastructure capability was also proved to affect the willingness to share information. The IT infrastructure capability that is accessible to the supply chain parties, helps in making the process easy and in that way, increases the willingness.

Kim and Chai [2017] also claim that information technology usage in the supply chain promotes information sharing The use of EDI already brings and stores information in the supply chain. The writers conclude, among other things, that in global sourcing, the buyers need to be proactive with information sharing with suppliers by adopting new

information systems and having frequent communication to make the supply chain more agile.

Companies can see information sharing as a loss of power [e.g. Li and Lin, 2006]. This is a reason there is a limited range of information that an organization would consider sharing with its key partners to collaborate with them more efficiently. This range can include e.g. inventory, sales, demand, forecasting, order status, product planning, logistics, and production schedules [Hadaya and Pellerin, 2008]. Not all organizations necessarily share any of this information with its suppliers. The purpose is not to propose to be completely open but to think what kind of information would be strategically wise to share to achieve efficiency in the collaboration.

Sayogo and Gil-Garcia [2015] suggest three key factors that are the predictors of success in inter-organizational information sharing: knowledge of information needs on both sides, knowledge about participating organizations and executive support and involvement. Markus and Bui [2012] add that formal and legal arrangements are also an important factor in their research about IT governance in the private sector. The knowledge of the information needs and knowing the partnering organization promotes common understanding of the purposes of the collaboration. The executive support and involvement is helping collaboration in many ways and as stated in the previous paragraph, top-management can also prevent collaboration, either deliberately or unintentionally if they are not aware of their important role in the collaboration.

Some of the achievable benefits from information sharing were stated in the research results of Nyaga *et al.* [2010]. There the buyers' investment in collaborative activities, such as information sharing, signals their commitment to the suppliers and increases the amount of trust in the relationship. Jaehne *et al.* [2009] add that collaboration between the partners is very important, because sharing up-to-date information leads to reduction of errors and delays thus reducing the need of rework later on. According to Li and Lin [2006] information sharing will bring the company competitive advantage by speeding up the information flow, making the supply chain more responsive and responding to the changing needs quicker.

3. Inter-organizational systems

There are two terms mainly used for inter-organizational systems in the information systems literature: inter-organizational information system (IOIS) [e.g. Hadaya and Pellerin, 2008] and inter-organizational system (IOS) [e.g. Wei and Wang, 2007; Madlberger and Roztocki, 2009]. Here the term inter-organizational system (IOS) is used collectively. In this thesis, the term IOS is not bound to mean only the traditional IOSs (computer-to-computer connection), but also the existing and developing web-based applications, cloud-based information systems and other possible IT-supported systems that are used to carry out inter-organizational collaboration activities.

Inter-organizational system (IOS) means the electronic linkages between trading partners [Madlberger, 2009]. Kumar and van Dissel [1996] add to the description that IOSs are systems that transcend legal organisational boundaries. Trading partner can mean all partners up and down the supply chain, but in this paper the partners are the suppliers.

IOS is discussed here not only from the system point-of-view, but seeing it as a continuum and as a part of inter-organizational collaboration. Romano *et al.* [2007] describe technology supported inter-organizational collaboration as the integration of people, information systems, processes and infrastructure between different organizations, regions and nations to enable productive teamwork and reaching mutual goals.

There has been a growing need for IOS because it is no longer necessarily possible to achieve efficiency only within the company's internal limits and IT-tools. Inter-organizational systems are the enabler for enhanced collaboration between companies in supply chains [Madlberger, 2009].

Basically, the general IOC can be performed without any information system support (collaborating face-to-face, workshops etc.), but it might no longer be efficient. Gunasekaran and Ngai [2004] say that without the support of an information system, it is difficult, even impossible, to execute a successful collaboration between parties in the supply chain.

Fawcett *et al.* [2011] found in their research that the IT investments that are made to enable the dynamic capabilities of an organization, such as a collaborative action that go beyond the firms boundaries, are the most profitable. Their research was aiming to provide guidelines for IT investments designed to improve the supply chain performance. In the results they emphasized that the balance of technological solutions and cultural factors is able to bring up unique capabilities. This is one reason why inter-organizational systems are built.

IOS enables for example vendor-managed inventory that requires regular information sharing between the partners [e.g. Turban *et al.*, 2015] and employees from another firm could for example see the inventory levels or recent transactions of a business partner by having access to the partner's information system [Fang et al., 2014]. Other examples of collaboration enabled by an IOS in the buyer-supplier relationship are supplier relationship management, production planning, collaborative product design, sharing information, joint development of strategic plans and synchronizing operations [Barratt, 2004; Daugherty et al., 2006].

It should be taken into account that these external actions made with one partner affect the internal processes and the rest of the supply chain as well [Barratt, 2004]. For example, deciding to share information with 1st tier supplier in the joint system means that the information can flow upstream to their suppliers if not for some reason defined confidential. And in some cases, the information should flow upstream in one way or another, for example to be able to reduce the bullwhip-effect (for bullwhip-effect see chapter 3.4).

3.1. Integration in inter-organizational systems

Large companies are seeking possibilities in inter-organizational systems integration to protect their competitiveness. Systems integration was originally used for completing technical and operational tasks. Now it has evolved to having more strategic capabilities that enable companies to develop joint systems. [Hobday et al., 2005] Organizations can benefit from IT-integration that is needed for digital collaboration in many ways. Even only the fact that the company is able to enter the collaboration that the information system enables is a development and beneficial for the company. Through digital IOC companies can enhance the efficiency of data exchange, conduct business process reengineering and develop innovative ways of information sharing with the partners. [Madlberger and Roztocki, 2010]

Hobday et al. [2005] argue that systems integration is a manifestation of a firm's dynamic capabilities. Therefore, it is a key to the broader competitive strategy of the firm and the position a firm takes within the value stream of an industry at any given time. They add that systems integration can also be used to manage outsourcing. System integration capabilities can therefore be used to gain the advantages of both outsourcing and vertical integration and collaboration with the suppliers. System integration is only one part of digital inter-organizational collaboration, but it is an important technological aspect and an enabler of the collaboration.

Today's IT-development makes the commitment and structuring of an IT-supported supply chain network easier, also for smaller companies with smaller IT-budgets. The development and usage of application programming interfaces (APIs) makes the systems integration simpler. E.g. Bond [2015] mentions the usage of APIs in cloud services. Large companies that are the dominant parties of the supply chain have also widely understood the importance of standards to support supply chain integration [Aerts et al., 2004]. An example of such standard is the EDI-standard that is used to send and receive computer-to-computer messages. EDI was the first inter-organizational channel before the expansion of the internet [Saldanha, 2006]. Still most of the integration is done by intermediaries that set up the integration between the systems [Korpela et al., 2016].

To automate the process of information sharing, the different systems of the suppliers in the supply chain must be integrated in a global network (E.g. EDI). Mi *et al.* [2005] suggest that instead of using technologies such as EAI (Enterprise Application Integration, see e.g. Manouvrier and Ménard [2008]), companies can use more flexible web services to integrate their systems. Web-systems are more dynamic in nature and in the end even less expensive to use. Schrödl [2012] says that cloud-computing has high potential in almost every main process in a company (plan, source, deliver, return). The making process (manufacturing) is still lacking support of cloud-based systems because of the individuality of the process in every company.

The way the systems are integrated is up to the partner companies and their existing information systems as well as the collaboration needs. One option is that the partners can integrate both parties' systems together, e.g. interconnecting buyers SCM-system to the suppliers' CRM-system (probably through the ERP-systems) [Selk et al., 2005]. Cloud services also provide several integration possibilities to other services and clouds [Bond, 2015]. Depending on the purpose of the collaboration, it might be enough to give the other partner access to the partner's system using a web browser [Morrow, 2012].

For traditional organizations that have already established enterprise systems, Gawer [2009] suggests that these existing systems could be seen as building blocks where other complementary technologies can be integrated. Sedera and Lokuge [2018] call these complementary technologies, such as cloud computing, mobile, wearables and social media, *digital technologies*. Enterprise systems are the systems organizations use to run their core business processes. Leading providers at the moment are SAP AG, Oracle Corp. and Microsoft. Figure 3 shows the comparison between the two types of systems and their qualities.

Sedera and Lokuge clarify the classification between the two types of systems by borrowing McKinsey's management consultants' concept of 'two-speed IT system' (from Avedillo *et al.* [2015]), which is managing new and old technologies in a single IT portfolio. The challenge for traditional organizations is to use both the existing slow systems and new fast digital technologies to create a value adding IT portfolio [Avedillo *et al.*, 2015].

Enterprise systems	**Digital technologies**
Rigid	**Flexible**
Enterprise Systems architectures tend to be more rigid than those of digital technologies	
On-premise	**Hosted**
Enterprise Systems tend to be on-premise. Some digital technologies are available as subscription based	
Steep learning	**Ease of learning**
Enterprise Systems are complex and hard to learn. Systems based on digital technologies are easy to learn	
Necessitate substantial change	**Changes are minimal**
Enterprise Systems implementations require substantial changes. Digital technology changes are manageable	
Low trialability	**High trialability**
Trialing an Enterprise System is hard. Much of digital technologies can be trialed with less interventions	
Business process orientation	**Functional orientation**
Enterprise Systems tend to provide process orientation. Digital technologies can focus on functions	
Capital expenditure	**Operating expenditure**
Enterprise Systems tend to be a capital expense. Digital technologies can be managed as an operational expense	

Figure 3. Comparison of enterprise systems and digital technologies [Sedera & Lokuge, 2018]

The implementation of an IOS must also fit to a larger business strategy of the organization. Aerts *et al.* [2004] describe in their research how the business architecture, information and communication technology (ICT) platform architecture and the application architecture experience parallel development that is explained by mutual influence and alignment in relation to one another. In other words, the changes in one architecture have an enabling or driving influence on the others. The different dimension and their influences are pictured in Figure 4.

Business architecture defines the whole business system in the organization's environment of suppliers and customers. It consists of people, resources (including ICT), business processes and rules. Application architecture describes how the software applications interact with each other. ICT platform architecture combines the resources (computers, networks, peripherals, operating systems, database management systems, UI

frameworks, UI frameworks, system services, middleware etc.) which are used to build the system for the organization. [Aerts et al., 2004]

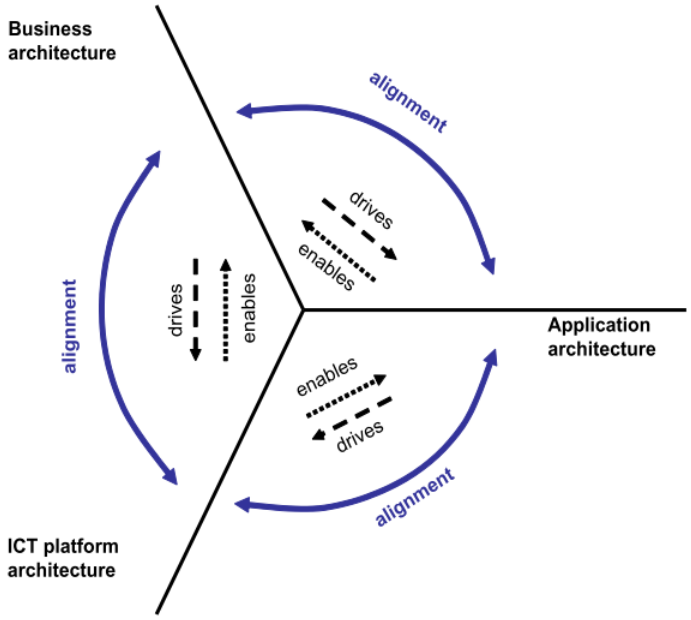

Figure 4. The dimensions of alignment [Aerts et al., 2004]

The business development is the driver of the development of the other two architectures. What is beneficial for this research to notice, that the ICT platform and application architectures act as an enabler to the development in the business architecture. [Aerts et al., 2004] Computer system architecture and decisions do not drive the business decisions. The systems should instead align to the shape of the business and enable the developments. Aerts *et al*. [2004] are discussing the internal development and alignment of the different areas. In business, there are of course many external factors that affect the decision making of an organization.

3.1.1. Platform services

One form of digital collaboration is emerging with platforms. In a platform economy, all the participants can create value without the limits of a more traditional pipeline supply chain structure. One technologically advanced company offers a platform (or several) where the other system members align their investments and strategies. Platforms can have many forms. It can for example impact consumers directly like in a smartphone operating system or work behind the scenes. Behind the scenes it can e.g. be a software that a manufacturing company uses to monitor and coordinate its suppliers. [Teece, 2017] This is one example of a concept describing the multilevel digital collaboration

throughout the supply chain and gathering several kinds of actions under one very broad term.

Platform strategies have previously been utilized by the born-digital organizations, such as Amazon or Google. Now also the non-technological, asset heavy companies are starting to utilize platforms to make their business grow and create strategies to use them. [Daugherty *et al.*, 2016] Daugherty *et al.* [2016] do emphasize the fact that even though there is a big macroeconomic shift through the platform business models (Airbnb does not own any real-estate, Uber does not own any taxis etc.), it does not mean that if you adopt the model, you must give up your existing value chain model. The most important thing is to find your place in the platform economy and have a strategy to utilize the strength offered by it.

Thinking from the systems point-of-view, the enterprise systems (e.g. provided by SAP or Oracle) can also be thought as a technology platform that a company can use to facilitate innovation. The enterprise system as a platform can act as a base where other applications, processes or technologies are developed and integrated. [Sedera and Lokuge, 2018] So instead of thinking that the enterprise system is connected to a platform, the enterprise system could be the actual platform. The concept of a platform is very broad and it is not handled thoroughly in this thesis. The foundation of platform technologies are cloud services [Daugherty *et al.*, 2016], which are handled in chapter 3.1.2..

3.1.2. Cloud computing

The National Institute of Standards and Technology (NIST) has published a widely accepted definition of *cloud computing*:

> "Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. "[NIST]

In cloud computing, the building, maintaining, upgrading and operating the computer system is the responsibility of the provider, instead of the company's IT department. The organisations also have a choice from a variety of service providers and are not locked to one. According to Bond [2015] this results in faster deployment of services at a lower cost and makes it possible for the company to concentrate on its core functions.

Bond [2015] is also stating that the shift to the cloud does not have to be an all or nothing transition. This is an important point for the executives because suddenly shifting all your information systems at once sounds rather exhausting.

Legacy systems can be a sensitive subject to many companies. The systems have been developed with lots of money, love and care in a time where the information flow was not nearly as massive as it is today. Bond [2015] suggests that the legacy systems should also be revised and evaluated, if they still meet the ever-changing needs of organisations. Changing the system is not always the answer, but as with all the processes in the business environment, the information systems should as well be re-evaluated.

Cloud systems make it easier for companies to join and exit the collaboration because they are easy-access and scalable [Chandra & van Hillegersberg, 2015]. Cloud architecture supports inter-organizational information sharing, because all participants are meant to use common data [Schrödl, 2012]. This does not have to mean, that all the participants have access to all the data, but simply, that all the information that is shared, is based on the same data.

There are known issues to be considered when using cloud-based systems. An example of a safety issue is that these services can be accessed using a web browser from a personal device (e.g. mobile phone, computer or a tablet) that is not managed by the employer organization. There is a possibility of leakage of confidential data if the possible risks are not controlled on the devices. This can be handled internally for example by demanding that employees are connected to the company network when accessing company data. [Morrow, 2012]

If a cloud-based system is used for inter-organizational collaboration, the security issues on the partner's side have to be considered as well. Handling the Bring Your Own Device (BYOD) security issues internally might succeed, but making sure the partner has the same policies might be a lot trickier. The platform providers might ensure data safety on their side, but the users must do their part as well. More about BYOD security, see e.g. Morrow [2012].

There is a large variety of platforms available and some of them are even free of charge. It is depending on the final use, which one a company should choose. It is a joint effort between the cloud service provider and the customer to secure the data in the cloud. Users must be advised how to use the system safely and the cloud service provider must provide information to the customer about the safety of their system. Before entering into an agreement with a cloud service provider, the organization should check how the vendor

handles and stores your data, where the data is stored, is it possible to restore data after a failure and if the organization as a customer is able to get their data back if the vendor company would go broke or get acquired by another company. [Brodkin, 2008]

3.2. Requirements for implementing a successful IOS

Top management support is a top priority in implementing IOC and IOS [e.g. Madlberger, 2009; Daugherty et al., 2006; Sayogo and Gil-Garcia, 2015]. Strategic collaboration requires organizational change, which has to be led accordingly [e.g. Teece, 2017]. Management must be aware of their role as an enabler or a plug to collaboration and progress.

Baraldi and Nadin [2006] stress the importance of commitment both to business partners and to the IT-project from all involved firms. The writers state, that when the parties are committed to the project, only then the conditions are met to start introducing IT-infrastructures that can automate the inter-organizational processes. So, there must be collaboration and commitment between the parties before trying to implement it through an IT-system.

Halonen [2014] states in her research about the implementation of an IOS, that the work process that the system is supposed to support has to be defined carefully. The IT-system itself does not generate the collaboration, but collaboration is the work process to be digitized.

Daugherty *et al.* [2006] provide ideas on what more is needed to make the collaboration work. The writers point out, that although there is a lot of research and talk about setting up a supply chain collaboration, there is not that much emphasis on the strategic aspects or long-term details. Daugherty *et al.* suggest that the partners should be chosen and matched more carefully, clear standards must be defined and a one to five years implementation plan has to be drawn up. Formal inter-organizational collaboration and systems need a strategy and a plan like any other long-term business activity. Planning here does not have to mean e.g. an extensive two-year planning period before anything is done, but making sure the parties are “on the same page” and agreeing how the collaboration is going forward.

The information sharing between the partners must be planned carefully with every partner in the system. Suppliers participate in several supply-chains and do business with several buyers and possibly deliver their products and services to the competitors as well. The partners, who of course cannot share confidential information to others, should have

an individual approach for planning and information sharing to retain the autonomy of the partners. [Jaehne *et al.*, 2009] The fact that every supplier has different qualities should be no news to the buying organization, but when planning a collaboration with several suppliers, it is tempting and might sound quicker to make only one plan for the whole collaboration. That might not bring the wanted results however.

An organization's understanding of their own processes is needed to be able to improve them. Also understanding the supplier's process and how it has an impact on the internal process must be considered. [Frankel *et al.*, 2002] So IOC and IOS require a fair amount of pre-work. Not only does the company need to understand its own processes and aims, but it has to understand the partner's aims as well to be able to build a successful collaboration system. If the requirements are specified unilaterally, it is not a collaborative action.

According to Auramo *et al.* [2002], identifying the processes affected by the collaboration is the first step. The business processes must also be modified to fit the IOS. If new technology is implemented to old processes, there is a danger to create only new, expensive and inefficient performance.

Identifying and observing the changes needed in the processes strongly links to the change management process and the supplier relationship management. The management should be aware of how the power influences towards the supplier can be managed. Like mentioned in chapter 2.2, according to Benton and Maloni [2005], supplier satisfaction is the feeling of equity in the relationship, no matter what power imbalance exists. That can mean in some cases that even if the IOS would not make the supplier's processes any different or it would even make them do more work for the buyer, if the supplier is satisfied with the relationship, the project can still succeed. But to achieve this, the pre-work still has to be done and different possibilities in the execution of the IOS must be clarified.

Some level of trust is one important factor in the success of an inter-organizational collaboration [Beckett, 2005]. Beckett concludes in his research that to build trust, there must be frequent and personalized communication between the partners. The communication must be complete so there are no surprises later. So, one important requirement for the success of an IOS implementation is participants' willingness to communicate and the readiness of the system to support the communication.

The parties taking part in the collaboration must be autonomous and voluntary [Hartono & Holsapple, 2004] and they must both have power over their actions. If more control is

given to other participants, the process becomes more one of compliance than collaboration [Wood and Gray, 1991]. In addition to this, the loss of autonomy can weaken a company's position compared to its trading partners [Madlberger, 2009]. This is an important issue to be kept in mind because there can be some preconceptions about the power arrangements in the relationship on both sides.

Madleberger's [2009] study revealed that the key factors effecting information sharing of an organization were mainly internal factors: company's own information policy, top-management commitment, internal technical readiness and perceived benefits (see chapter 2.3, Information sharing). Hadaya and Pellerin [2008] came to a similar conclusion when inspecting IOS-methods used in manufacturing firms. They name four determinants that have an impact on the intent to use inter-organizational systems to share information. They are the company's dependency on its key suppliers, the level of collaboration with the supplier, the experienced pressure from its key suppliers and the experienced pressure by the technology experts. So, the will and enablers to use information technology to collaborate and share information must be acquired internally in a company and the existing relationship with the supplier must fit the intent to develop it further with an IOS. See also chapter 2.2, Buyer-supplier relationship management, on the subject.

3.3. Challenges

Entering in to a more open relationship with your business partner and sharing information is still difficult for most large firms. Daugherty *et al.* [2006] put it well saying that there is an almost inherent distrust or uneasiness in such situations. Trust is only one issue in this, even though the lack of it creates a clear barrier to IOC. The challenge is to step out of the organizational silo and start making decisions and plans that are mutually beneficial to the collaborative partners.

Loebbecke *et al.* [2016] talk about the paradox of protecting versus sharing. It is a current problem to be solved for the organizations that wish to benefit from the recent resource-leveraging strategies. They suggest different control mechanisms for different kinds of knowledge. In IOS, the technical coordination and control mechanism is applied. The coordination of the knowledge sharing between companies is done through a system that has different levels of access to different users. The researchers emphasize that all types of information require some amount of social coordination and control. All the control cannot be left to an information system or a contract. If not controlled in some way, inter-personal information sharing can lead to some unintended sharing and that could compromise the company's attempt to manage the paradox of protecting versus sharing.

The change in work and the possibility of disappearing jobs is a challenge for the users in implementing a new information system, be it intra- or inter-organizational [Brynjolfsson and McAfee, 2011]. This phenomenon is not something that has been recently discovered. John Maynard Keynes [1930] has inspired several researchers (e.g. Frey and Osborne, 2017) with his prediction of *technological unemployment*, which is "unemployment due to our discovery of means of economising the use of labour outrunning the pace at which we can find new uses for labour."

Computerization is not the only means of reducing needed labour. Companies can e.g. increase single employee's workload, use temporary and part-time employees or redesign processes to restructure their operations [MGI, 2011]. Jobs do not disappear automatically by launching a computer system, but through implementation of organizational strategy. Business strategy drives the change in the ICT platform [Aerts et al., 2004], like described in Figure 4.

The system supported collaboration discussed in this thesis very much includes a human to interpret the information and make decisions based on it. The aim is however to propose ways to reduce manual work in sharing information by automating tasks and making better use of the data in the organizations.

Chandra and van Hillegersberg [2015] list some challenges that are typical for IOC. There can be information system challenges, such as legacy systems and incompatible infrastructure, operations challenges, such as missing cost-benefit evaluations and finally organizational challenges like lack of trust, power imbalance and conflicting goals. Some of these can be tackled with technical solutions, some are more management issues.

One risk is that the participants of the IOS will not join or contribute actively if they see a possibility that the leading organization may behave opportunistically or that they might lose competitive advantage by joining the IOS. [Markus & Bui, 2012] The partners can think that the dominant company is going to use their data to gain competitive advantage [Chandra & van Hillegersberg, 2015].

Resistance is a common reaction when launching a new information system [Bond, 2015]. Lapointe and Rivard [2018] approach the subject with a perspective that resistance is neither good nor bad. The writers refer to their previous research which indicates that the implementer's reaction plays a role in if the resistance is functional (signals the existence of problems) or dysfunctional (causes disruption). It is important that the implementer

(e.g. business manager, IT professional) of the information system understands why the users resist the new system. [Rivard & Lapointe, 2012]

In literature, authors describe resistance mainly in three ways; neutrally, negatively and positively, the latter being the least common approach. Neutral resistance is a reaction or a response from the users, negative approach is portraying resistance as a problem or an opposition and positive resistance could be a clue of what went wrong. [Lapointe & Rivard, 2018]

Security of web-based systems is always an issue to be discussed and it is a concern to organizations that have been so long trying to protect their information and keep it to themselves. The use of IOS brings another dimension of security threat, which reaches across the whole network of companies they are directly or indirectly linked to [Fang et al., 2014].

3.4. Benefits of a shared system

In this chapter some of the possible benefits gained from inter-organizational collaboration and inter-organizational systems are listed. The benefits here are not something that are achieved automatically in every case, but examples of the possible outcomes. To be able to achieve benefits with IOS, the requirements must be met and the challenges identified and managed.

It is noted in the extant research that not all the benefits of platforms and shared systems can yet be named. For example Faraj *et al.* [2018] and Parker *et al.* [2016] say that the economic and relational value created by these network effects is superior to that of a traditional value chain because of the unexpected synergies that take place between all the platform participants. The IT integration itself creates an important base and means of digital inter-organizational collaboration. Firms with integrated IT infrastructures are better enabled to develop higher capability of supply chain process integration [Rai *et al.*, 2006].

IOS can increase the responsiveness of the supply chain by enabling on-time, accurate and transparent information sharing among the supply chain partners. For example real-time demand information could be transmitted to upstream suppliers. [Roh et al., 2014] Kim and Lee [2010] add that the combination of IT competence and IOC can improve market performance through the improvement of supply chain responsiveness. They continue that without systems collaboration, joint coordination and planning with the partner can become challenging because of inadequate communication and information

sharing. If the IOS is built in a way that it supports the communication and information sharing between the partners [Beckett, 2005] it helps reducing the amount of e-mails internally and externally and also help store the communication history in single place.

Many times, the collaborative actions of two organizations are done between single representatives of the two companies. This leads to a case where if one of the participants leave their position, the relationship is in danger to weaken significantly [Frankel *et al.*, 2002]. It can also be the case that the same person is responsible for several relationships to suppliers. This multiplies the risk of losing information when changes in personnel happen. If the collaborative actions are done with the help of an IT-system, the activities and plans can be saved in the system. A system does not of course replace or solve the personal relationships [Jaehne *et al.*, 2009]. If the collaboration itself is planned so, that there are more than one key participants involved from each company, the risk of losing information in case of someone quitting or changing position decreases. Also in the planning of the system it must be taken into consideration that all the relevant parties should have access to the information.

One important benefit of inter-organizational information sharing is the reduction of the bullwhip effect. The bullwhip effect is a distortion in the supply chain that increases when moving further upstream. [Lee *et al.*, 1997] This distortion results in excess inventory and safety stock and the amount grows as one moves up the value chain. It can be reduced by information sharing and all the parties looking at the same data, instead of everyone making their own estimates from different data sources or only working with the previous link in the chain. [Turban *et al.*, 2015]

4. Case study introduction

4.1. Case study organization

The case company is a part of a larger group of companies based in Finland. The parent company is in the process manufacturing industry, but the case company is more in the industry of assembly or fast-moving consumer goods. The case study data was mainly gathered from the case company representatives but part of the information also came from the parent company. Many of the information system decisions are made on a group level, hence the view and opinions of the parent company representatives were important to include in the research.

4.2. Development of a supplier information management system

The case company has at the time of writing the thesis recently launched a new cloud-based Supplier Information Management (SIM) system. The system is meant to better control all the internally gathered supplier information and make it more easily accessible. One purpose of launching the system is to reduce the amount of e-mails and to move a large part of the communication into the system.

The system is implemented by combining the data from the organization's ERP-system to the additional information that is not yet stored in any other systems. The master data would not be stored in the SIM-system, but only presented there. The IT-architecture related to the SIM-system is pictured in Figure 5. The service provider did not have an off-the-shelf solution for the case company. The system was built and adjusted according to the existing processes in the case company. Many of the processes moved to the system were previously mainly maintained in employees' own excel-files.

The initial purpose of the SIM-system was to provide supplier information to the internal users, which was done in phase 1. The system users are mainly from the sourcing, procurement, supply chain and R&D functions. There were, however, some problems in getting the relevant external information to the users as well. One solution to this was a portal for the supplier to be able to communicate with the relevant people in the case company. The platform used for the SIM-system could support this kind of supplier integration and the decision was made to execute the collaboration platform in phase 2.

Phases 1 and 2 were not eventually executed in consecutive order according to the initial plan. The execution of phase 2 began before the end of phase 1, so the internal part was not yet complete and the users were not acquainted with the system before the enablement of external users to the system.

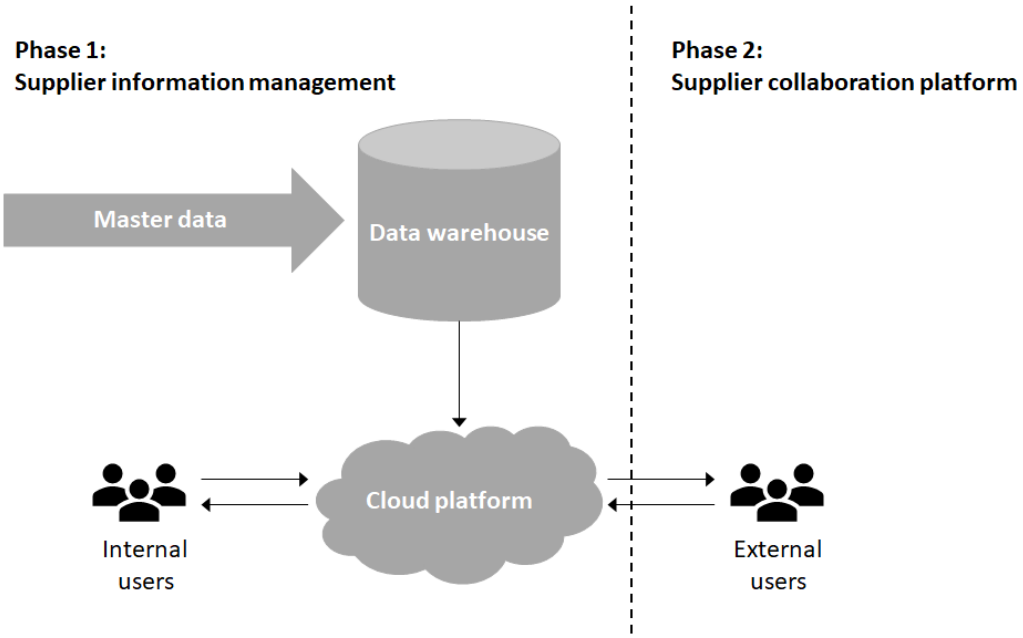

Figure 5. IT-architecture related to the supplier information management system

The collaboration through the platform is started with a few partner suppliers that have agreed to pilot the system. Initially the key account manager of the supplier will have access to the system and to the defined information. The supplier will be able to see their information in the case company's system and to update some of their information, such as contact people. After the piloting the new development ideas are gathered and the collaboration platform is developed according to those.

Collaborating through an information system is a new way of working in the case company. This research was conducted to see if the company has taken all the required issues into consideration and if there are any barriers to the successful implementation of the system and the collaboration. Because the phase 1 of the SIM-system was not yet completed at the time of writing this thesis, issues in internal information sharing are also discussed.

5. Results

The phases of implementation of the survey and the interviews are introduced first before the actual results and findings. The comments from the interviews are combined with the survey results. The results are presented in four different main categories: information systems, external information exchange and quality of information, quality of collaboration and internal information sharing. The survey results are presented with frequency tables and descriptive statistics. Part of the interview results are summarized in a table and other relevant comments are mentioned in the text.

5.1. Survey

The survey was directed to the potential users of the SIM-system and the interviews were done with the management of the case company and its parent company. The survey was conducted through Qualtrics Survey Software and the statistical analysis was made with the help of IBM SPSS Statistics.

The survey was sent globally via e-mail to 105 respondents who are in contact with the raw material suppliers of the case company. The survey was open for two weeks. First reminder was sent after one week to the participants who had not finished the survey and a final reminder one day before the survey's closing. 71 responses were gathered altogether. 7 participants started the survey but did not finish. Those records were left out of the analysis.

The questions of the survey were chosen to represent certain themes that are important to successful IOC and IOS. The questions measure the level of communication and collaboration, information sharing and the quality of it, commitment, transparency, trust and IT-system adequacy. Themes were acquired from extant IOS and IOC research from Madlberger [2009] and Damlin *et al.* [2013]. Some questions were developed together with the case company's management. In the survey the respondents were asked to consider their five most important trading partners [Madlberger, 2009].

The survey questions were replied with a 5-point Likert scale. There were 38 agree/disagree statements (between 1 = "Strongly disagree" and 5 = "Strongly agree") and 13 importance measuring questions (between 1 = "Not at all important" and 5 = "Extremely important"). At the end of the survey there was also a free text field where the respondents could share their ideas about IT-systems that could better support buyer-supplier collaboration. 25 respondents left some comments and they are summarized in the survey results. None of the questions were mandatory. In the Likert scale questions there were only six missing values. The missing values were in different questions and in

the data analysis the missing values were simply ignored. The survey was conducted in English and no language versions were provided, because English is the case company's main language.

The respondents were asked some background information before the actual survey questions. This included the respondent's function and region, how often the respondent is in contact with suppliers and which systems and devices are used for information exchange and contacting the suppliers. The collected background information of the participants is presented in Table 1. Background questions.

It can be seen from Table 1. Background questions, that over one third of the respondents were from the R&D department. The next biggest groups were from business, sourcing and supply chain functions. Regionally the respondents were divided well and every region had several replies. Most of the respondents, almost 40 per cent, were in contact with the suppliers daily, but there were also over 20 per cent who had contact less often than monthly. The most common systems and devices used when contacting the supplier were phone and e-mail. Face-to-face was also a popular means of contacting the supplier. These systems are all non-IOS information exchange mechanisms [Saldanha, 2006]. Systems that enable inter-firm sharing (EDI and online portal) only got chosen eight times.

Function	Frequency	Percent
Business	10	14,08
Management	2	2,82
Procurement	5	7,04
Production	7	9,86
Quality	5	7,04
R&D	24	33,80
Sourcing	9	12,68
Supply chain	9	12,68

Region	Frequency	Percent
Americas	15	21,1
APAC	19	26,8
EMEIA	27	38
Global	10	14,1

Contact with suppliers	Frequency	Percent
Daily	28	39,4
Weekly	17	23,9
Monthly	11	15,5
Less frequently	15	21,1

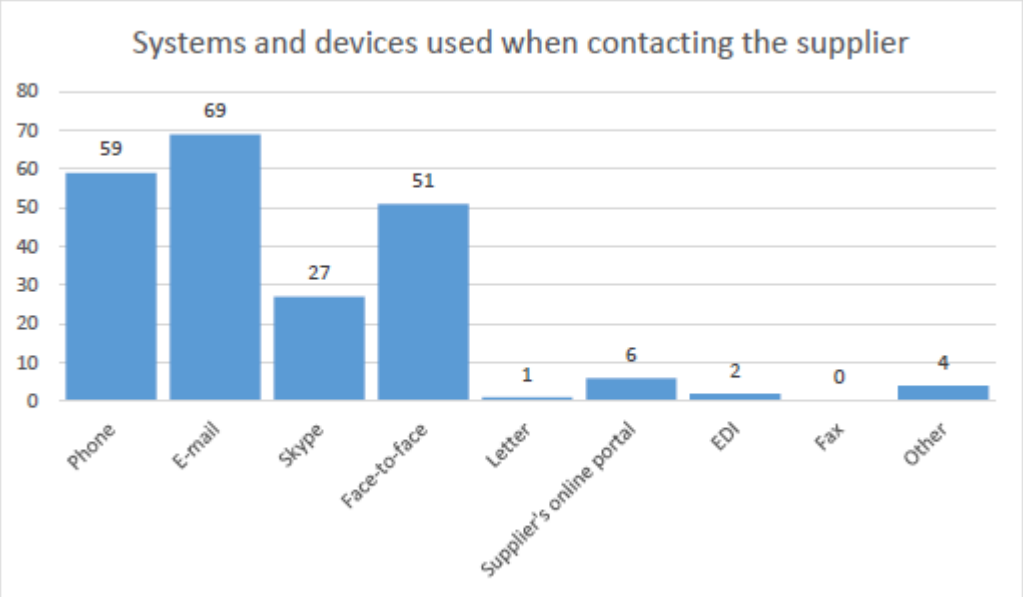

Table 1. Background questions

5.2. Semi-structured interviews

The interviewees were chosen by the thesis writer based on the suggestions of the sourcing management of the case company. The people chosen represented different fields of expertise in the sourcing organization of the case company and its parent company. The interviews were done after the survey. The themes were similar than in the survey but the aim was to get more in-depth knowledge about the subject. The initial idea

was to use the survey results as a base for the interviews, but due to a tight schedule, the survey results were not analyzed thoroughly before the interviews.

Five interviews were conducted during January 2018. Two participants were from the parent company. One representative was responsible of the IT services and the other interviewee of sourcing development. Three participants were managers in the global sourcing and procurement organization of the case company. Two of them also participated in the survey. The amount of the interviewees was designed to get coverage of different fields in the case company. All participants had different responsibilities, hence the situation in the company was seen from several different points of view. The parent company interviewees provided a view of the common development plans as a whole and the three participants from the case company gave answers through their own experience in sourcing and procurement.

Through the interviews made to the sourcing management of the case company and representatives of its parent company, the readiness (system and organizational) and willingness to use and invest in an IT-system to collaborate with external suppliers was clarified. The questions and themes also aimed to find the barriers and perceived benefits of an IOS.

The themes of the interviews were based on the themes in the survey. They were: general IT-development, internal and inter-organizational information systems, information sharing, supplier collaboration and change management. The questions under the themes varied depending on the interviewee and some of the themes (e.g. IT-development) were not handled in depth with all the interviewees. This decision was based on the job description and knowledge of the interviewee.

Four interviews were made face-to-face and one as a Skype call. In the interview invitation, a maximum duration of one hour was mentioned. The actual interview duration varied from 30 to 40 minutes. The face-to-face interviews were held in conference rooms where there was no distraction during the interviews. All the interviews were done in Finnish and the discussions were translated afterwards by the thesis writer. In the beginning of the interviews, the participants were explained the purpose of the interview and the participants were asked to briefly introduce themselves and their responsibilities in the organization. This was followed by the discussion of the main topics. The interviewer guided the discussion through the predefined themes. Additional questions were asked according to the interviewee's knowledge and interest. The conversation itself was let to flow freely to different directions.

5.3. Information systems

This chapter goes through the interviewee's comments concerning IT-development plans in the case company as well as the survey results concerning internal information systems in use and their importance.

5.3.1. Development plans

According to the information gathered during the interviews the information system development is strongly moving to cloud based services and further developing the cloud services that support the ERP system. Digitalization, supplier connectivity and group-level cloud-based solutions that support sourcing processes are the main themes in sourcing's IT-development in the parent company.

The development is in a transitional stage at the moment. Industry-wise, the process manufacturing industry is lagging behind e.g. the car and electronics industry in supply chain collaboration.

> *"Process industry is probably 15 years behind assembly industry in supply chain collaboration. The production cycles in processing industry are much longer than in assembly industry."*

Vendor integration and connectivity is something new that has not been executed in a large scale before in the case organization, even though it can be classified as being more in the assembly industry than in process manufacturing. Now that the parent company is aiming to that direction, it has risen as a one important theme in the case company as well. According to a longer plan, the new systems launched for the sourcing function will have an opportunity for the supplier or other partner to log in or integrate into the system. Even though it is clearly planned that the systems are going to change, there are some weaknesses:

> *"We do this in a kind of traditional way. Now the technology is developed based on as is instead of seeing everything through developing operation models. This is a bit of a flaw."*

Also in the case company, the new SIM-system was developed based on existing processes and they were mirrored as is in the system. In the beginning there were some issues in understanding how the current information systems actually work (e.g. ERP-system) and seeing how the work processes could be moved to the system.

> *"It became apparent that the people, somehow, even though they work like that every day, do not necessarily fully understand how they actually work."*

There is a feasibility study on the group level to be launched for a supplier integration channel. It is planned so, that all the communication and collaboration with the supplier from the qualification-step onwards would be channeled there. If this development proceeds according to the sourcing strategy, the planned system will be the main system in sourcing for supplier communication. This can also mean that the case company's own SIM-system could eventually become redundant and they would move to the group level model. But the main point here is that the development is going towards IOC and IOS.

In the sourcing function of the case company there are similar kinds of hopes that were mentioned in the development plan on the sourcing's group level.

> *"A platform for supplier collaboration would help directing activities more efficiently through a single tool."*

Some of the requirements to process automation in general were well understood in the sourcing management level: understanding of own processes, information sharing and mutual willingness to collaborate were all mentioned. Some areas need more attention, such as top management support and improving internal change management.

> *"One thing we are missing here is the drive from top management. Not all people start using the system spontaneously, some people need someone to tell them what should be done."*

The survey results presented later in this chapter show that even though the themes mentioned above (understanding of own processes, information sharing and mutual willingness) are known on the management level, there is work to be done on the user level.

In the SIM-system collaboration the suppliers use the case company's system. It is however possible in the future to integrate also the supplier's data source to the system, for example to show delivery status. This development would bring the ordering and delivery data from both partner's own ERP systems to one single platform.

> *"It is important to understand in the design-phase, if operations change dramatically due to the integration. Not because of the technical implementation,*

but because of the internal operation models. Some things may become more centralized or maybe automated so far that they effect the organization."

The perceived advantages and possible risks and challenges of a shared system with a supplier gathered during the interviews are summarized in Table 2.

Supplier relationship	**IT development**	**Information sharing**	**General**
+Using suppliers as a resource +Getting suppliers do things for us +Deeper integration might affect supplier relationship positively +Working together for the common good +See the people who are working together +Developing common performance measures +Supplier can see relevant information of the business relationship -Motivation problem for the supplier, if it is forced to use some certain system with us	+Faster reaction to changes +Avoiding double work and unnecessary steps in processes +Reducing manual work +Automation leaves more time to value adding work +Increasing efficiency in the supply chain +Application world is more user friendly than ERP-systems +Suppliers can integrate to our solutions -Change resistance a big challenge -Lack of time and resources to learn to use the system -System is precise, people not necessarily -Users not using the system or slow to start if the system is not simple and flexible -+Risks concerning data security should be mitigated in the building phase -Malfunction of a critical integration, maybe not understanding the effect to the whole process -Risks coming from the supplier's systems	+Seeing relevant data in one place +Transparency of information +Improving communication +Master data accuracy increase +New employees find information in one place +All the information is saved in the system -Partner seeing the other partner's information by accident -Uploading information to the platform that the supplier is not supposed to see -People do not want to give up their information	+Following cases and projects more closely (updating, seeing current status) -+Difficult to see the potential benefits just yet +Reducing waste in the supply chain (financial advantage) +-Automation affecting the organization's internal operation models, challenge if not taken into consideration -Supplier having separate internal systems and others with other customers and then this with us -Project lacking some drive from the top management

Table 2. Benefits and risks of a shared information system

In the comments from the survey it could be seen that not all of the respondents saw any direct advantage in using IT-systems for the collaboration with suppliers, but they

emphasized the personal contact. One of the commenters was satisfied in the situation as it is.

> *"In R&D work these IT-systems are not that relevant. We need to have good connections to the people to make projects further."*

> *"I am more "old-school" and prefer phone conversations and face-to-face meetings for collaboration. IT-systems can help with collecting and storing information but people collaborate!"*

> *"I would say that I have enough to make my work."*

There were some features mentioned in the comments that would help the system to serve the users better and support the collaboration, such as flexibility, platform enabling two way and internal communication and sharing ideas as well as a place to store common information:

> *"Flexibility. There is no "one model" or "one template" or "one process" which would ever fulfill the needs of all. Sourcing works with a very wide variety of different suppliers, only inside direct materials. Therefore, flexibility of tools generally, as well as "on-demand" functionality is the best. This means that tools & systems need to adapt to very different requirement of different businesses, and not the other way around ("this is our process and this is how you need to work")."*

> *"IT- system should create more visibility and transparency. We should also have a place to store common information that would be always available and up to date. Currently we are doing a lot of manual work on operational level as well as on strategic level and IT systems should help us to automate our processes, internally and in collaboration with our suppliers."*

> *"Info sharing inside our company!"*

> *"Platform to share ideas can help to improve collaboration which also encourages two-way communication stream"*

Flexibility, mentioned in the comments, is in line with Bhatt et al. [2010] who says that the flexibility of an IT system influences information generation and sharing. Those then increase the responsiveness and the company's capability to react to the fast-changing environment.

Some comments listed precise wishes, what could be done in the system:

> *"Access to web pages and financial reports. Business forecasting for dynamic supplier forecasting without excessive manual work."*

> *"It would be good to have IT-systems, which can be used in our internal project work, but also handle the supplier part in the same systems. Also, DoC and the certificates should be easy to handle with the suppliers."*

> *"Public IT system. Supplier could update the data, upload documents and other information and company's specified group could check the supplier's updating. But supplier only could check the information relative to them."*

> *"Standardized reporting forms could reduce manual work by teams directly co-operating on a regular basis with suppliers / data bank could support company level info sharing and benchmarking"*

One comment also saw the opportunity of keeping the data up-to-date together with the supplier and others seeing the shared data as well:

> *"Open the data to both sides and regularly review it together"*

> *"Some kind of IT platform where product development and suppliers can have an access. No matter if I start some discussion about a project or a quality issue with some raw material, others also can see this. It will limit e-mail exchange and also give the opportunity that others will get the information."*

5.3.2. Current situation in the case company

The survey cleared the current situation concerning the opinions and usage of the information systems in the case organization. Table 3 and Table 4 show us that according to the survey results, most employees have adequate access rights to the needed systems and the attitude towards IT-systems is mostly positive (question: I think that IT-systems help me in my work, about 75% somewhat or strongly agreed). There was more variation in the replies to the questions about IT-system adequacy when contacting the suppliers and the IT-systems being up-to-date. The amount of manual work when preparing reports is high for about 45% of the respondents.

The large amount of manual work also came up during the interviews.

> *"Whenever we are meeting a supplier, we are doing a huge amount of manual work. I hope that we could concentrate more on the substance of the work. […] It takes a lot of time to find the information from different systems and from different people. "*

Same challenges as in the interview can be observed from the survey results in finding the information concerning the suppliers (mean = 2,63, on a scale of 1-5) and saving and documenting new ideas developed with the suppliers with a mean of 3,18.

To which extent you agree or disagree with each statement		Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I have access to the necessary IT-systems to be able to perform my work tasks.	Count	0	6	10	41	14
	%	0,0%	8,5%	14,1%	57,7%	19,7%
I feel that the IT-tools I use when I'm contacting suppliers are sufficient.	Count	3	16	13	31	8
	%	4,2%	22,5%	18,3%	43,7%	11,3%
Needed information concerning our suppliers can be easily found from the IT-systems I use.	Count	12	21	20	17	1
	%	16,9%	29,6%	28,2%	23,9%	1,4%
The amount of manual work is high when preparing a report to be sent to the supplier.	Count	1	14	24	20	12
	%	1,4%	19,7%	33,8%	28,2%	16,9%
I can easily save and document the new ideas I develop with suppliers.	Count	5	11	27	22	6
	%	7,0%	15,5%	38,0%	31,0%	8,5%
I think that IT-systems help me in my work.	Count	2	5	11	42	11
	%	2,8%	7,0%	15,5%	59,2%	15,5%
The IT-systems in my company are up-to-date.	Count	4	14	13	32	8
	%	5,6%	19,7%	18,3%	45,1%	11,3%

Table 3. Opinions about IT-systems and their use

	Mean	Std. Deviation
I have access to the necessary IT-systems to be able to perform my work tasks.	3,89	0,82
I feel that the IT-tools I use when I'm contacting suppliers are sufficient.	3,35	1,084
Needed information concerning our suppliers can be easily found from the IT-systems I use.	2,63	1,072
The amount of manual work is high when preparing a report to be sent to the supplier.	3,39	1,035
I can easily save and document the new ideas I develop with suppliers.	3,18	1,032
I think that IT-systems help me in my work.	3,77	0,898
The IT-systems in my company are up-to-date.	3,37	1,099

Table 4. Descriptive statistics for IT-systems

When asking about the importance of IT-systems and their functionalities, functioning IT-systems and reducing manual work were more important than mobile IT-systems. It can be observed from the number of respondents in different options, seen in Table 5, that the opinions were not completely unanimous, but the means (listed in Table 6) were highest for functioning information systems and reducing manual work. In the interview one interviewee did hope for a system that could be used offline, because e.g. when travelling, it is not always possible to connect to the internet.

Define how important are the following factors for you in your work		Not at all important	Slightly important	Moderately important	Very important	Extremely important
Functioning IT-systems	Count	0	4	17	32	18
	%	0,0%	5,6%	23,9%	45,1%	25,4%
Mobile IT-systems that are available everywhere	Count	2	16	19	26	8
	%	2,8%	22,5%	26,8%	36,6%	11,3%
Reducing manual work when e.g. creating reports	Count	2	3	19	27	20
	%	2,8%	4,2%	26,8%	38,0%	28,2%

Table 5. Importance of IT-system functionalities

	Mean	Std. Deviation
Functioning IT-systems	3,9	0,848
Mobile IT-systems that are available everywhere	3,31	1,036
Reducing manual work when e.g. creating reports	3,85	0,98

Table 6. Descriptive statistics for importance of IT-systems and functionalities

5.4. External information exchange and quality of information

The quality of the received information from the supplier is mostly on a good level in the survey replies. The information received is mostly relevant to the respondents' work (mean = 4,27, in Table 8). The opinions whether the data is up-to-date or in a correct format varies. A little over a half of the respondents somewhat or strongly agree with these two statements but the rest either somewhat disagreed or neither agreed nor disagreed. Over 60% thought that the data received can be efficiently used but on the other hand over one third could not agree with that statement, as can be observed in Table 7.

To which extent you agree or disagree with each statement		Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
The information I receive from the supplier is relevant for my work.	Count	0	0	7	38	26
	%	0,0%	0,0%	9,9%	53,5%	36,6%
The information I receive from the supplier is always up-to-date.	Count	1	12	21	31	6
	%	1,4%	16,9%	29,6%	43,7%	8,5%
The data I receive from the supplier is in the correct format.	Count	1	10	22	36	2
	%	1,4%	14,1%	31,0%	50,7%	2,8%
I can efficiently use the data I receive from the suppliers.	Count	0	12	15	38	6
	%	0,0%	16,9%	21,1%	53,5%	8,5%
Suppliers share enough information with me.	Count	3	21	18	24	5
	%	4,2%	29,6%	25,4%	33,8%	7,0%
More information should be shared with our suppliers	Count	2	16	33	12	8
	%	2,8%	22,5%	46,5%	16,9%	11,3%
My work is often delayed because of lacking data.	Count	8	16	26	18	3
	%	11,3%	22,5%	36,6%	25,4%	4,2%
I mostly send structured and predefined reports to suppliers.	Count	8	18	26	16	3
	%	11,3%	25,4%	36,6%	22,5%	4,2%
Suppliers send me mostly structured and predefined reports.	Count	5	13	28	22	3
	%	7,0%	18,3%	39,4%	31,0%	4,2%
I share more information with the supplier than the supplier with me.	Count	12	20	30	8	1
	%	16,9%	28,2%	42,3%	11,3%	1,4%

Table 7. Opinions about information sharing and its quality

The questions concerning external information exchange did not have very high means, they were between 2,52 and 3,11, as presented in Table 8. The statement "Suppliers share enough information with me" got supporters on both sides. When asking about the amount of information, the results slightly tilt on the supplier's side. In more cases they share more information with the case company, than the case company with them. Over 30 respondents thought that the situation was quite mutual, they neither agreed nor disagreed.

Survey respondents were not quite sure if more information should be shared with the suppliers. Almost half (46,5%) neither agreed nor disagreed.

> *"To achieve a harmonized level of transparency on a company level is difficult. Our people rather tell too little, so they do not reveal too much."*

One manager from the case company mentioned that the level of openness can be increased in a controlled way in strategic partnerships. The survey respondents were asked to reply concerning their five most important suppliers, which can also include strategic partners, but they were still not sure about increasing openness.

	Mean	Std. Deviation
The information I receive from the supplier is relevant for my work.	4,27	0,632
The information I receive from the supplier is always up-to-date.	3,41	0,919
The data I receive from the supplier is in the correct format.	3,39	0,819
I can efficiently use the data I receive from the suppliers.	3,54	0,876
Suppliers share enough information with me.	3,1	1,044
More information should be shared with our suppliers	3,11	0,979
My work is often delayed because of lacking data.	2,89	1,049
I mostly send structured and predefined reports to suppliers.	2,83	1,042
Suppliers send me mostly structured and predefined reports.	3,07	0,976
I share more information with the supplier than the supplier with me.	2,52	0,954

Table 8. Descriptive statistics for the quality of information

The opinions about if the respondents work was delayed because of lacking data were divided quite evenly. Almost the same amount of people agreed, disagreed or were in the middle. In the statement it was mistakenly not pointed out, if external or internal data was in question and this might have had an effect on the responses. The format of the reports sent between the case company's representatives and the supplier also varies from structured to non-structured. The survey does not tell if it is varying case-by-case or if it is person or function dependant.

The type of the reports and information is also an issue to consider when designing an IT-tool meant to support information sharing. This result about the information format also supports Jaehne *et al.*'s [2009] research, that an individual approach for the participants of the collaboration is required.

When evaluating the importance of external information sharing and its quality, the quality factors (on-time mean = 4,38, and up-to-date information mean = 4,59, in Table 10) were seen more important than sharing information with the suppliers (mean = 3,76). This is understandable, because the benefits of on-time and up-to-date information are easier to see than the benefits of sharing information with the suppliers, which are more long-term benefits. Importance of sharing information with the suppliers also divided the respondents the most, as can be seen from Table 9 and Table 10. That factor had the highest standard deviation (0,836).

Define how important are the following factors for you in your work		Not at all important	Slightly important	Moderately important	Very important	Extremely important
On-time information	Count	**0**	**1**	**4**	**33**	**33**
	%	**0,0%**	**1,4%**	**5,6%**	**46,5%**	**46,5%**
Up-to-date information	Count	**0**	**0**	**3**	**23**	**45**
	%	**0,0%**	**0,0%**	**4,2%**	**32,4%**	**63,4%**
Sharing information with our suppliers	Count	**0**	**5**	**20**	**33**	**13**
	%	**0,0%**	**7,0%**	**28,2%**	**46,5%**	**18,3%**

Table 9. Importance of quality of information

	Mean	Std. Deviation
On-time information	4,38	0,663
Up-to-date information	4,59	0,575
Sharing information with our suppliers	3,76	0,836

Table 10. Descriptive statistics for importance of the quality of information

5.5. Quality of collaboration

The interviewees told that there are not that many specific tools that are used to contact or do collaboration with the supplier. Basic tools like e-mail and phone were mentioned. They were the most popular tools used according to the survey as well. The new SIM-system was seen as a future option for the collaboration by the case company representatives. Overall, increasing transparency was a repeating theme in supplier collaboration development.

The current quality of collaboration was measured in the survey with questions regarding willingness to collaborate, trust, commitment, contact person in the partner company and knowing the suppliers' processes. The questions can be seen in Table 11. The willingness to collaborate from the buyer's perspective is not an issue. Nearly all of the respondents either somewhat or strongly agree that they are willing to collaborate with the suppliers. When evaluating the supplier's willingness, the mean was slightly lower (mean = 4,13, in Table 12), but still high.

To which extent you agree or disagree with each statement		Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Suppliers are willing to collaborate with me.	Count	0	1	6	47	17
	%	0,0%	1,4%	8,5%	66,2%	23,9%
I am willing to do collaboration with suppliers.	Count	0	0	2	25	44
	%	0,0%	0,0%	2,8%	35,2%	62,0%
I have a lot of informal conversations with the supplier.	Count	6	18	15	21	11
	%	8,5%	25,4%	21,1%	29,6%	15,5%
The relationship with the suppliers is long-term oriented.	Count	0	6	6	31	28
	%	0,0%	8,5%	8,5%	43,7%	39,4%
I know the supplier's processes that are relevant for my work.	Count	0	15	12	33	11
	%	0,0%	21,1%	16,9%	46,5%	15,5%
The suppliers are committed to the business relationship between us.	Count	0	1	13	48	9
	%	0,0%	1,4%	18,3%	67,6%	12,7%
The contact person in supplier's company is a good match.	Count	0	6	12	45	7
	%	0,0%	8,6%	17,1%	64,3%	10,0%
The role of the supplier in our operations is important.	Count	0	1	0	23	47
	%	0,0%	1,4%	0,0%	32,4%	66,2%
The supplier keeps our best interests in mind.	Count	2	9	26	30	4
	%	2,8%	12,7%	36,6%	42,3%	5,6%
Suppliers keep their promises.	Count	0	10	15	41	4
	%	0,0%	14,3%	21,4%	58,6%	5,7%
When making decisions, suppliers consider our welfare as well as their own.	Count	1	12	22	33	2
	%	1,4%	17,1%	31,4%	47,1%	2,9%
There has been a lot of changes in contact persons of our suppliers during the past two years.	Count	7	22	19	18	5
	%	9,9%	31,0%	26,8%	25,4%	7,0%
The change in personnel of the partner company hasn't affected my work.	Count	3	14	22	27	5
	%	4,2%	19,7%	31,0%	38,0%	7,0%

Table 11. Opinions about the quality of collaboration with the supplier

The willingness to collaborate was found strong also in the interviews in the case company:

"We will strengthen the long-term partnerships in the future."

"Both, us and the supplier, want to improve our results by working together."

Informal communication (statement: "I have a lot of informal conversations with the supplier"), which is also part of IOC [Caglio & Ditillo, 2008], had the largest variance in the responses (Std. Deviation = 1,223, mean = 3,18, see Table 12). The respondents of the survey are the potential users of the IOS, so the system should be able to support different communication needs of the users, be it formal or informal.

	Mean	Std. Deviation
Suppliers are willing to collaborate with me.	4,13	0,608
I am willing to do collaboration with suppliers.	4,59	0,55
I have a lot of informal conversations with the supplier.	3,18	1,223
The relationship with the suppliers is long-term oriented.	4,14	0,899
I know the supplier's processes that are relevant for my work.	3,56	0,996
The suppliers are committed to the business relationship between us.	3,92	0,603
The contact person in supplier's company is a good match.	3,76	0,751
The role of the supplier in our operations is important.	4,63	0,567
The supplier keeps our best interests in mind.	3,35	0,88
Suppliers keep their promises.	3,56	0,81
When making decisions, suppliers consider our welfare as well as their own.	3,33	0,847
There has been a lot of changes in contact persons of our suppliers during the past two years.	2,89	1,115
The change in personnel of the partner company hasn't affected my work.	3,24	0,992

Table 12. Descriptive statistics for quality of collaboration

The question about informal communication also connects with the questions regarding the contact person in the supplier company. Hansen [2009] has listed barriers to collaboration and one of them is *the transfer barrier*, where the people are not able to collaborate with someone they don’t know well enough. The contact person in the supplier’s company is a good match in almost 75% of the cases in the survey, which leaves a quarter of the respondents to think otherwise.

There is quite a lot of variance in the replies to the question if there have been many changes to the contact persons and if it has had an effect on the respondent's work. It is to be noted when looking at the replies and mean values of these two questions, that the formulation differs from the others in the set. The replies to the first one (concerning the changes in contact person) does not picture a positive or a negative situation, just how it has been for the past two years and the last one is a reverse statement.

The role of the supplier in the case company's operations is seen very important with very little variation in answers. Two questions measuring commitment (long-term oriented relationship and perceived supplier's commitment) received high means, 4,14 and 3,92 respectively.

Trust-related questions (supplier keeps our best interest in mind, keep their promises and considers our welfare as well as their own) had lower means than commitment-related questions and there was also more variance in the answers. Moberg *et al.*'s [2002] research results suggested that firms may not even expect trust from the trading partners, but will change information with them if the relationship is long-term oriented (high commitment level). Even though trust would not have an effect on information sharing [Madlberger, 2009], it does support the collaboration [e.g. Cannon *et al.*, 2010].

Understanding and recognizing the supplier's processes that are affected by the collaboration is one important step in preparing the collaboration [Auramo et al., 2002; Frankel et al., 2002]. Over 60% of the survey respondents either somewhat or strongly agree with the statement that they know the supplier's processes affecting their work, but there is still room for improvement. The person developing the new system for supplier collaboration agreed that the processes need to be understood, but that person does not normally work in a supplier interfacing role to clarify the processes.

The most important factor in the supplier relationship from the survey was a trustworthy supplier. All the factors got high means, which can be seen from Table 14. The lowest mean in this set was for frequent communication with the supplier. It also had the greatest variance. It is seen as important, but not as important as the contact person, close and long-term collaboration and trust in the relationship. The importance of trust shows that it is an important factor for the respondents in the relationship with the supplier, even though it might not affect the information sharing. It can be seen from Table 13, that most of the factors were either very or extremely important.

Define how important are the following factors for you in your work		Not at all important	Slightly important	Moderately important	Very important	Extremely important
Frequent communication with supplier	Count	0	4	11	33	23
	%	0,0%	5,6%	15,5%	46,5%	32,4%
Right contact person on the supplier's side	Count	0	0	4	32	35
	%	0,0%	0,0%	5,6%	45,1%	49,3%
Close collaboration with suppliers	Count	0	1	6	31	33
	%	0,0%	1,4%	8,5%	43,7%	46,5%
Long-term relationships with suppliers	Count	0	1	1	28	40
	%	0,0%	1,4%	1,4%	40,0%	57,1%
Suppliers who can be relied on to keep their promises	Count	0	0	1	19	51
	%	0,0%	0,0%	1,4%	26,8%	71,8%

Table 13. Importance of quality of collaboration

	Mean	Std. Deviation
Frequent communication with supplier	4,06	0,843
Right contact person on the supplier's side	4,44	0,603
Close collaboration with suppliers	4,35	0,699
Long-term relationships with suppliers	4,53	0,607
Suppliers who can be relied on to keep their promises	4,7	0,49

Table 14. Descriptive statistics for importance of quality of collaboration

5.6. Internal information sharing

Internal information sharing was a theme suggested by the case company. Information sharing in general is a prerequisite for collaboration [Madlberger, 2009] and the parties who share it can also be internal employees. One important reason for launching the collaboration system in the case company, is to increase visibility internally.

One of the standouts in this question set was the statement “I share the information received from our suppliers with my colleagues when it is necessary”. The perception of necessity is naturally very subjective. This statement had a high mean of 4,54 (see Table 16). Still the sharing is not in its highest level, because about 40% only somewhat agreed with this statement (see Table 15). This statement would have needed a pair, where the last four words would have been left out to compare the results.

To which extent you agree or disagree with each statement		Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I have access to necessary internal information to be able to perform my work tasks	Count	1	8	16	33	12
	%	1,4%	11,4%	22,9%	47,1%	17,1%
Others in the organization benefit from the information I receive from the supplier.	Count	1	4	13	35	17
	%	1,4%	5,7%	18,6%	50,0%	24,3%
I share the information received from our suppliers with my colleagues when it is necessary.	Count	0	0	2	29	40
	%	0,0%	0,0%	2,8%	40,8%	56,3%
I save the information received from the supplier on an internally shared platform (e.g. team site).	Count	4	26	20	15	6
	%	5,6%	36,6%	28,2%	21,1%	8,5%
I might keep information to myself until someone requests for it.	Count	16	24	15	15	1
	%	22,5%	33,8%	21,1%	21,1%	1,4%
I am the only person responsible of communicating with these suppliers.	Count	48	12	9	1	1
	%	67,6%	16,9%	12,7%	1,4%	1,4%
I am aware of the projects that other members in our company are doing with my partner suppliers.	Count	3	26	15	17	10
	%	4,2%	36,6%	21,1%	23,9%	14,1%
I am aware of the projects that other members in our company are doing with other suppliers.	Count	10	28	8	20	5
	%	14,1%	39,4%	11,3%	28,2%	7,0%

Table 15. Opinions about internal information sharing

The new SIM-system is seen as a helpful tool in internal information sharing:

> *"When you hear something about a case, the information can be put in one place and it is available to everyone. […] If this is done by e-mail, there can be several e-mail chains about the same topic"*

It can also be clearly seen from the results that in most cases more than one person is in contact with the suppliers in the respondent's scope (they were asked to consider the five most important suppliers in their work). 48 people (67,6%) strongly disagreed with the statement "I am the only person responsible of communicating with these suppliers".

Even though the respondents were not the only ones communicating with the supplier, the awareness of the on-going projects with them varied. Regarding this statement a few more replies were on the 'disagree' (40,8%) than on the 'agree' (38%) side. The

awareness of other projects besides the ones with people's own partner suppliers was somewhat poor with a mean of 2,75.

	Mean	Std. Deviation
I have access to necessary internal information to be able to perform my work tasks	3,67	0,944
Others in the organization benefit from the information I receive from the supplier.	3,9	0,887
I share the information received from our suppliers with my colleagues when it is necessary.	4,54	0,556
I save the information received from the supplier on an internally shared platform (e.g. team site).	2,9	1,071
I might keep information to myself until someone requests for it.	2,45	1,106
I am the only person responsible of communicating with these suppliers.	1,52	0,876
I am aware of the projects and activities that other members in our company are doing with my partner suppliers.	3,07	1,163
I am aware of the projects and activities that other members in our company are doing with other suppliers.	2,75	1,216

Table 16. Descriptive statistics for internal information sharing

Over 55% disagreed with the statement that they might keep the received information to themselves until someone requests for it. This question is not specifying the type of information or if it really needs to be shared without asking. Still most of the respondents (nearly 75%) agreed that others in the organization benefit from the information they receive.

One barrier from Hansen's [2009] barriers to collaboration is called *the hoarding barrier*, which means that people are unwilling to provide help. The reasons can be for example fear of losing power, competition with colleagues or simply being too busy. An IOS can help improving internal as well as external information sharing, but even there the users must be willing to share the information.

Without a clear plan of how and where the information is shared, there are some issues:

> *"Currently we do not know if the information is stuck somewhere."*

The interviewees did not mention any problems in information sharing in critical situations, when there is a bigger problem on either side.

Access to the internal information was mainly good, with the mean of 3,67, but there was some variance in the replies. The survey reveals that the information is not nearly always saved on any internally shared platform, where others would have access to it as well. Only about 30% somewhat or strongly agree, when asking if the information is saved e.g. on a team site.

To be able to achieve the improvements in transparency and communication internally as well, there needs to be some change in saving and sharing the information. The users will not get the advantages of the shared platform if they do not share the information in the system.

From the two importance statements connected to internal processes, internal information sharing was rated more important than clearly defined processes, with means of 4,32 and 3,96 respectively, in Table 18. The distribution of the replies can be seen from Table 17. Internal information sharing is seen as an important part of the work but the previous results from the agree-disagree statements show that there are some issues to be solved. Also, clearly defined processes are important to most of the respondents (73,2%).

Define how important are the following factors for you in your work		Not at all important	Slightly important	Moderately important	Very important	Extremely important
Clearly defined processes and procedures	Count	2	3	14	29	23
	%	2,8%	4,2%	19,7%	40,8%	32,4%
Internal information sharing	Count	0	0	6	36	29
	%	0,0%	0,0%	8,5%	50,7%	40,8%

Table 17. Importance of factors affecting internal information sharing

	Mean	Std. Deviation
Clearly defined processes and procedures	3,96	0,977
Internal information sharing	4,32	0,627

Table 18. Descriptive statistics for importance of factors affecting internal information sharing

6. Analysis and discussion

The findings of the survey and the interviews are discussed here regarding the two research questions:

1. *What is required to successfully enhance inter-organizational collaboration with the help of an information system?*
2. *What kind of organizational barriers exist to a successful implementation of an inter-organizational system?*

The survey and the interviews addressed the different requirements to a successful supplier collaboration. Through those results it can be seen what still needs to be done in the case company to be able to enhance the collaboration in general and through the SIM-system. The barriers to the successful implementation of an IOS can lie in different areas, e.g. in the information systems, willingness of the personnel or in the current information sharing practises.

The research showed that the employees of the case company are committed to the supplier relationship and they are willing to collaborate with the suppliers, who are considered to be an important part of the operations. The supplier is also perceived as being committed and willing to collaborate. The partners to pilot the new collaboration tool were chosen carefully by the case company and there was a one-year plan made with them. Those were also mentioned as requirements to a successful collaboration.

One area that needs attention in the case company is the process of information sharing. In that area the main barrier found was that the people do not share information that much, even internally. Hansen [2009] calls this the hoarding barrier and the reasons can be for example fear of losing power, competition with colleagues or being too busy. The importance of information sharing is shown in many researches, e.g. Wu et al. [2014]and Nyaga et al. [2010].

According to the interviews, there is some level of insecurity about what can be shared overall and that the information system project needs more top-management support. Here the results from this study support Madlberger's [2009] results, where top-management commitment affects strategic information sharing. In the survey comments there were some clear wishes of increasing mutual information sharing and developing a common platform, so a part of the respondents already sees that beneficial. The task is now to get everyone on board internally as well.

From these survey results and the interviews, it can be observed that the supplier is wished to be more open with the case company but in some cases the information flow to the

suppliers' direction is not seen that important. This was the result even though the willingness to collaborate was perceived mutually high and the importance of the supplier was acknowledged. One exception mentioned in an interview was the strategic partnerships, where it could be possible to increase the openness towards the supplier in a controlled way.

An IOS can clarify the guidelines on internal and external information sharing and through that it can also decrease the amount of insecurity when sharing information. The IOS itself can be seen as the guideline. The system used for IOC in the case company has defined places for different types of information. If there is for example a place for R&D project plans, the user knows that it is permitted to upload the information about the projects into the system. This also increases internal visibility of information.

To improve the external information sharing, certain information in the system is opened to the supplier. The users can use the system to share and store the information but they do not have to make decisions what is visible internally and externally. Those decisions are made already earlier and built in the system. These actions manage the paradox of protecting versus sharing information [Loebbecke et al., 2016]. In addition to the coordination provided by the information system, social control is needed to minimize the possibility of unintended information sharing. Part of the information is still going to be shared through inter-personal interaction instead of the IOS.

Zaheer and Trkman's [2017] research suggests that trust affects the willingness to share information. The results of this survey support that. In the results the questions measuring trust had means between 3,33 and 3,56 (see Table 12). The question if more information should be shared with the supplier had a mean of 3,11 (in Table 8). The willingness to share was not very high and trust towards the supplier was not much higher either. Both results were just above the middle (3 = neither agree nor disagree). However, a trustworthy supplier was the most important factor for the respondents, with the mean of 4,7 (in Table 14), when defining the importance of the different factors in the survey. There is a clear gap in the current and the wanted situation concerning trust towards the supplier.

Beckett [2005] suggests that to build trust, there must be frequent and personalized communication between the partners. The communication must be complete so there are no surprises later. If the trust-level can be increased, the willingness to share information should rise with it.

Finding the information concerning the raw material suppliers of the case company was found challenging according to the survey. The survey answers do not reveal the reason for this, but the situation can be improved if there is one tool, which summarizes all the information concerning the trading partner. To gather this information, it requires master data accuracy, possibly system integration from other internal and maybe also external systems and users who update and maintain the information. Having the information in one place makes the reporting based on it simpler, which reduces manual work. About 45% of the survey respondents thought that the amount of manual work when preparing reports is high at the moment.

To understand and recognize the processes also on the suppliers' side that are affected by the collaboration is an important step in the preparation of the collaboration [Auramo et al., 2002; Frankel et al., 2002]. This issue needs to be clarified with the pilot suppliers of the new collaboration system and also with other suppliers that join any IOS used in the case company. It could be seen in the survey results and part of the interviews that there was room for improvement in this area. 62% of the survey respondents somewhat or strongly agreed to the statement that they know the suppliers' processes that are relevant for their work. In the interviews it came out that it is known that the processes need to be understood also on the supplier's side, but no actions have been made to clarify them.

One result where enhancement is needed is that the business processes should be modified to fit the IOS. This was mentioned in the extant research and in one of the interviewees comments. One challenge is that the SIM-system is built to fit the existing processes as they are. According to Auramo *et al.* [2002], if new technology is implemented to old processes, there is a danger to create only new, expensive and inefficient performance. Implementing the same processes in a new system can also increase change resistance towards the system, because the users cannot see the benefit of changing the system, if the processes are exactly the same as in the old system.

It became clear from the interviews, that on the group level the plans about launching systems which provide access and integration possibilities to the suppliers are already in progress. This reveals that the company can see the value adding possibilities of such systems. Value adding factors are the improvements that increase efficiency in the supply chain and they are happening gradually through the IOC. The amount of waste in the supply chain is decreased by sharing specific information more efficiently and on time. Before the benefits can be seen, the collaboration must be prepared. The collaboration is not generated by the information system, instead the collaboration process is moved to the system and digitized. At the moment, the main issues lie in the internal information sharing practises and in going through the processes concerned by the development.

7. Conclusions and implications

The newly introduced information system in the case company encourages information sharing and has the possibility to increase transparency, but the willingness of the employees to share information should be increased with top-management actions. Top-management's commitment has an effect on strategic information sharing and one way to encourage partners to share more information is the improvement of own information transparency [Madlberger, 2009]. More top-management commitment was also required in the information system project itself.

The business processes that are affected by the collaboration must be modified to fit the IOS to avoid creating merely new, expensive and inefficient performance. [Auramo et al., 2002]. In the case company the new information system has been designed to fit existing internal processes. The research shows that the current processes or systems used are not the most efficient and there are clear wishes of development. Now the potential of the system to support and develop inter-organizational collaboration and internal and external processes concerned is to be utilized.

Gaining internal information transparency is one important objective in launching the SIM-system in the case company. According to the survey results and interviews, there is a gap between the current situation and the desired level of transparency. Now, using the currently available information systems, finding the information concerning the suppliers was seen more difficult than easy. The reason for it is that in most cases, the information is not saved in shared platforms. This is something that the use of the new information system has a possibility to improve, but the internal information sharing in the case company needs more support.

The information system provides guidelines what to share and where, which is decreasing insecurity and coordinates external information sharing. Social control, such as relational contracting, personal relationships and team working complement the coordination provided by the system [Loebbecke et al., 2016]. Using the IOS to share information with the supplier increases the internal visibility of information.

According to the extant research the collaboration between companies can be enhanced using an inter-organizational information system. The value adding effects of the system can be achieved through the improvements in efficiency in the supply chain. The system development in the case company is heading towards a more open and responsive supply chain but the implementation of strategic collaboration using an information system is a new way of working. To be able to benefit from the new collaboration systems, development is needed to the processes.

Automating processes can reduce the amount of manual work and through that leave time to the more value-adding work. This, together with the possibility of avoiding double work and unnecessary steps in the processes when communicating with the suppliers more efficiently, provides a great chance in streamlining the work processes with an IOS.

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APPENDIX: SURVEY

Raw Material Supplier Collaboration Survey

Welcome to the raw material supplier collaboration survey!
The answers of the survey are used to develop the IT-tools that are used today for collaboration and information sharing with our raw material suppliers. The survey is also part of a master's thesis written to the University of Tampere.
When answering the questions, please consider the five most important raw material suppliers with whom you are in contact. Several questions are about information sharing and information here means any kinds of reports, action plans, order and shipment data, informal communication etc.

The respondents' personal information will not be published and individual responses will not be identifiable from the results.
If you have any questions about the survey, please contact the sender.

1. Please choose your function:

- O Business
- O Management
- O Procurement
- O Production
- O Quality
- O R&D
- O Sourcing
- O Supply chain

2. Please choose your region:

- O Americas
- O APAC
- O EMEIA
- O Global

3. How often are you in contact (exchanging e-mails, chatting, calls etc.) with our raw material suppliers?

- O Daily
- O Weekly
- O Monthly
- O Less frequently

4. Which systems and devices you use when contacting the supplier or when sending/receiving information from them? You can choose several options.

- ☐ Phone
- ☐ E-mail
- ☐ Skype
- ☐ Face-to-face
- ☐ Letter
- ☐ Supplier's online portal
- ☐ EDI
- ☐ Fax
- ☐ Other, please specify: _____

5. Below are a number of statements. Please read each one and indicate to which extent you agree or disagree with each statement.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I have access to the necessary IT-systems to be able to perform my work tasks.	O	O	O	O	O
I have access to necessary internal information to be able to perform my work tasks	O	O	O	O	O
Suppliers share enough information with me.	O	O	O	O	O
Suppliers are willing to collaborate with me.	O	O	O	O	O
I am willing to do collaboration with suppliers.	O	O	O	O	O
I feel that the IT-tools I use when I'm contacting suppliers are sufficient.	O	O	O	O	O
More information should be shared with our suppliers	O	O	O	O	O
Needed information concerning our suppliers can be easily found from the IT-systems I use.	O	O	O	O	O
The amount of manual work is high when preparing a report to be sent to the supplier.	O	O	O	O	O
I can easily save and document the new ideas I develop with suppliers.	O	O	O	O	O
	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

I think that IT-systems help me in my work.	O	O	O	O	O
The IT-systems in my company are up-to-date.	O	O	O	O	O
The information I receive from the supplier is always up-to-date.	O	O	O	O	O
The information I receive from the supplier is relevant for my work.	O	O	O	O	O
The data I receive from the supplier is in the correct format.	O	O	O	O	O
My work is often delayed because of lacking data.	O	O	O	O	O
I mostly send structured and predefined reports to suppliers.	O	O	O	O	O
Suppliers send me mostly structured and predefined reports.	O	O	O	O	O
Others in the organization benefit from the information I receive from the supplier.	O	O	O	O	O
I can efficiently use the data I receive from the suppliers.	O	O	O	O	O
	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I have a lot of informal conversations with the supplier.	O	O	O	O	O
The relationship with the suppliers is long-term oriented.	O	O	O	O	O
I know the supplier's processes that are relevant for my work.	O	O	O	O	O

I share more information with the supplier than the supplier with me.	O	O	O	O	O
The suppliers are committed to the business relationship between us.	O	O	O	O	O
The contact person in supplier's company is a good match.	O	O	O	O	O
The role of the supplier in our operations is important.	O	O	O	O	O
The supplier keeps our best interests in mind.	O	O	O	O	O
Suppliers keep their promises.	O	O	O	O	O
When making decisions, suppliers consider our welfare as well as their own.	O	O	O	O	O
	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
There has been a lot of changes in contact persons of our suppliers during the past two years.	O	O	O	O	O
The change in personnel of the partner company hasn't affected my work.	O	O	O	O	O
I share the information received from our suppliers with my colleagues when it is necessary.	O	O	O	O	O
I save the information received from the supplier on an internally shared platform (e.g. team site).	O	O	O	O	O

I might keep information to myself until someone requests for it.	O	O	O	O	O
I am the only person responsible of communicating with these suppliers.	O	O	O	O	O
I am aware of the projects and activities that other members in our company are doing with my partner suppliers.	O	O	O	O	O
I am aware of the projects and activities that other members in our company are doing with other suppliers.	O	O	O	O	O

6. Define how important are the following factors for you in your work.

	Not at all important	Slightly important	Moderately important	Very important	Extremely important
Frequent communication with supplier	O	O	O	O	O
On-time information	O	O	O	O	O
Up-to-date information	O	O	O	O	O
Clearly defined processes and procedures	O	O	O	O	O
Functioning IT-systems	O	O	O	O	O
Mobile IT-systems that are available everywhere	O	O	O	O	O
	Not at all important	Slightly important	Moderately important	Very important	Extremely important
Right contact person on the supplier's side	O	O	O	O	O
Reducing manual work when e.g. creating reports	O	O	O	O	O
Internal information sharing	O	O	O	O	O
Sharing information with our suppliers	O	O	O	O	O
Close collaboration with suppliers	O	O	O	O	O
Long-term relationships with suppliers	O	O	O	O	O
Suppliers who can be relied on to keep their promises	O	O	O	O	O

7. How could IT-systems better support the collaboration with our suppliers? Feel free to share any thoughts and ideas about the subject!

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